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Aerospace SAFETY

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UNITED STATES AIR FORCE

Aerospace SAFETY

FOR AIRCREWS, MAINTENANCE & SUPPORT TECHNICIANS

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

Dear Fellow Pilots

About thirty years and a thousand combat missions ago I climbed into my first cockpit. Despite many memorable events in the intervening years, 1970 was one of the most rewarding—the U. S. Air Force experienced its lowest accident rate in history. As Director of Aerospace Safety, this gives me a great deal of personal satisfaction.

True, we can pat ourselves on the back, but there is one area where we need to redouble our efforts. Although the rate is good, pilot factor accidents still account for a lion's share of the accident statistics. Since I've been watching pilots fly airplanes for a long time, I feel qualified to kick this subject around a bit.

Looking back over the years, I wonder why or how I was fortunate enough not to get tagged with a pilot error—I've certainly had the opportunity. Sure, I've scraped a bird or two, but not through any fault of my own. To analyze how I managed to avoid this is difficult, but perhaps I can give you a bit of my philosophy on the subject.

I think that, without exception, every outstanding pilot I have known exhibits one clearly identifiable trait. Some call it conceit or confidence in his ability. I call it a success syndrome. He is confident he can successfully cope with any mission or emergency. He doesn't give up when things turn sour; there's always one more ace up his sleeve. Part of this success syndrome is positive thinking; the other, a product of his knowledge—knowledge of his machine and of his abilities. He knows his emergency procedures and he knows aerodynamics. In short, he's a professional. We talk a lot about professionalism these days. The term means different things to different pilots. To me it's knowing everything you can about the art of flying. Anything less is an invitation to disaster.

Good pilots acquire a sort of sixth sense, something that warns them when they are about to paint themselves into a corner. But there is nothing mysterious about this sixth sense. You acquire it through knowledge, training, experience and positive attitude, which, summed up, equates to professionalism.

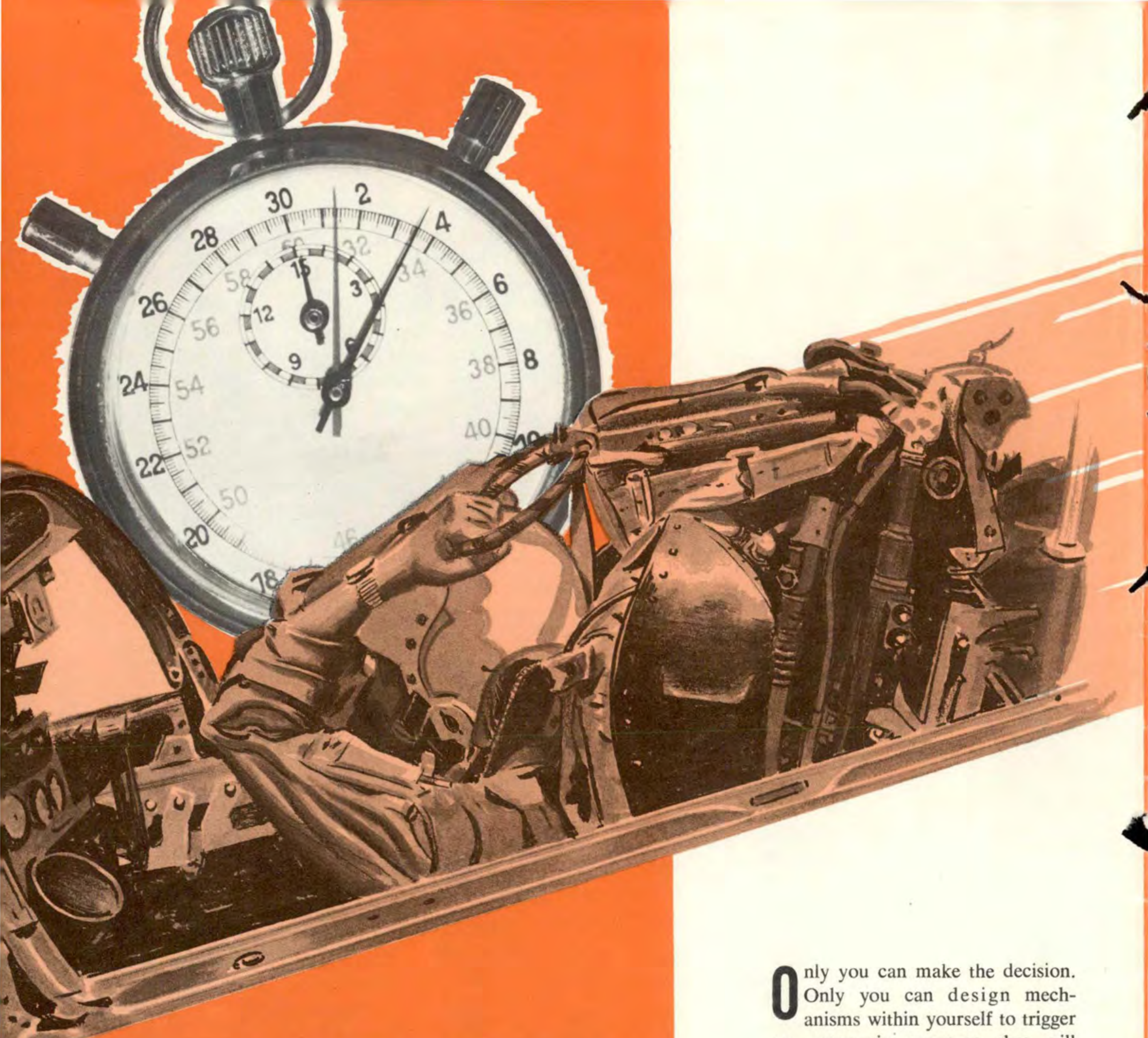
One of the most difficult things to understand is a pilot who closes his eyes to danger. The many accident briefs I've read make it painfully obvious that the ingredients that caused the accident were present before takeoff. In retracing the sequence of events we find that the pilot may have launched on a mission that was impossible to complete with the amount of fuel aboard, or he planned a mission into severe weather without any real operational necessity.

Pilot errors in spite of all our efforts are still the major cause factor in our losses. Our jocks still kill themselves and break airplanes needlessly. The only advice I can offer after all these years is, know your machine and its capabilities *and* know your abilities—exceed neither.

With reluctance I hang up my hard hat, goggles and scarf and wish each of you a career as rich and rewarding as I have experienced.

B. H. King

B. H. KING, Brigadier General, USAF
Director of Aerospace Safety



TIME TO GO

Only you can make the decision. Only you can design mechanisms within yourself to trigger an automatic sequence that will propel your body from the warm, comfortable atmosphere of your cockpit. How and when you elect to activate this sequence will remain a function of what has transpired until that time when something inside you says—EJECT! Whether the ejection occurs at twenty thousand in controlled flight or at 100 feet, outside of the envelope, the decision will have been made, not necessarily then but sometime in the past—perhaps without your knowledge.

We have to face certain things if we are to fly today's high performance aircraft, or any aircraft for that matter. One of those unpleasant facts is that, no matter how good we are with the stick and rudder, there may come a time when we are no longer master of our aircraft and are simply a passenger. When this occurs, whether we ride it in or elect to eject makes no difference to the fate of the bird. If it's doomed so are you, if you elect to remain a passenger.

The decision to eject has never been a very popular one, especially for the guy who has to reach down, pull the handle and admit that he has washed his hands of the whole unpleasant matter. When a pilot does this he has said to himself "I can't hack it anymore; it's too much for me." For any self-respecting pilot it's a difficult pill to swallow. What really bothers us is the fact that we might, just might, be wrong. Perhaps there is something else that could have been done to save the airplane. But one thing for sure, if his decision to stay with the bird is wrong, he's dead wrong.

There's an old axiom that says "Buddy, when it comes time to step over the side, you'll know it." This is true. The catch is to recognize THE TIME early enough to make the decision. Two jocks faced this problem when their T-33 flamed out at twenty thousand. Both agreed to jump at eight thousand if they were still in the weather. No change at eight; they were still in the weather, with no airstart, but decided to hold on down to six thousand and so on down to two thousand where, still in weather, with a dead engine the rear seat pilot ejected. The pilot in the front tried to go but the system refused to cooperate. He rode it in to his death. Had they stuck to the original decision *both* pilots might be alive. The pilot in front would have had time to at least give it a try over the side—it's been done before.

The troops who beat the bushes for better and more efficient ejection systems scratch their heads when the statistics show no improvement in survival rates, although our systems are better than ever. A possible answer is the, *"since the system is better, I can stay with it longer"* syndrome. It seems like a wise move for every pilot to take a critical look at the ejection envelope for his particular aircraft. Does it take into consideration bank angles, yaw or roll rates? How about dive angles? Make certain you know all the capabilities of the system.

Aside from the ostrich pilot who refuses to admit that the decision will ever confront him is the jock who, while in the companionship of his hangar flying buddies, makes such off-the-cuff predecisions as, *"I don't know of any airplane that's worth killing myself for,"* or *"I'm sticking by the Dash One, when 15,000 shows and I'm still out of control, I'm leaving,"* or maybe *"If things don't look real good at high key, adios."* Have you heard these gems? Maybe you've said them yourself. I had a friend who made those remarks, but, while deadsticking an '86, wrapped it up in a ball of flame short of the runway after he admitted over the radio at low key that things didn't look right to him. Why did he stay with it? He sensed the aircraft was doomed. Everyone on the ground recognized his peril and advised him to get out—yet he's dead.

We have the statement of one pilot who delayed but made it. *"Because of an innate fear of meeting accident investigation boards and FEBs I decided to make one effort to recover."* Was he subconsciously aware that the airplane was going to crash in spite of what he could do, yet had to give it one more chance? Fortunately he ejected in time. The harness he shed after getting on the ground was found between the two halves of the seat. He knew it was a desperate situation before he tried "once more." He knew the odds were against him.

TABLE 1
ALL EJECTIONS 1963-OCT 1970

SPEED AT EJECTION KIAS

ALTITUDE ABOVE GROUND LEVEL	0	1-49	50-99	100-149	150-199	200-249	250-299	300-349	350-399	400-449	450-499	500-549	550-599	N/A	UNKNOWN	TOTAL
UNKNOWN				1				1	1		1	1			25	30
40,000-49,999				1											2	3
35,000-39,999						2	1					1			1	5
30,000-34,999					1	1					1				1	4
25,000-29,999					2	4	10	1	1		2				2	22
20,000-24,999				1	1	5	2	8	3		2				4	26
15,000-19,999			1	3	2	8	7	8	4	3	1	2			5	44
10,000-14,999	1	3		8	12	29	11	3	6	2	1	2			7	85
5,000- 9,999	8	4	9	14	36	57	29	28	8	8	4	1	1		16	223
4,000- 4,999	1			2	16	26	9	9	2	1	2		2		10	80
3,000- 3,999		1	3	3	15	24	13	10	2	1	3				6	81
2,000- 2,999				19	27	25	19	18	8	3			1		13	133
1,000- 1,999	1		1	22	39	53	21	13	4	4		7			18	183
BELOW 1000 FT NOT SPECIFIED				1			3								5	9
500-999		2		13	20	20	7	6		3		3			5	79
250-499			2	12	17	18	2	1	1	1	2				5	61
100-249	1		3	11	10	15	5	2		1					8	56
1-99		1	5	10	18	4		2		1					9	50
GROUND EJECTION WCS		1	1	2	1	1										6
GROUND EJECTION NWCS	5	1	3		2	2								1	4	18
TOTAL	17	13	28	123	219	294	139	110	40	28	19	17	4	1	146	1198

WCS within capability of system
NWCS not within capability of system

Revised 23 Oct 1970

TIME TO GO

CONTINUED

Do you know of an accident board that chastised a pilot for leaving an airplane "when the odds were against him?" You may, but I don't. Pilots have ejected prematurely, at least that's the decision made by judges who sort through the facts after an accident. Quite possibly, those pilots who sit in judgement could have saved the machine, but then, on the other hand, could it be that the pilot who ejected early would have been doomed, along with his aircraft if he had attempted to salvage a desperate situation? The task may have been beyond his capabilities and so, in reality, the ejection was not premature from the point of view of this pilot's flying ability. When you lose your cool, chances are you are staring disaster in the face. The TIME for one pilot may not be the TIME for another in terms of proficiency.

Perhaps you've heard the story about one of our more illustrious pilots who, when faced with a flameout at 30,000 and no restart, calmly requested a GCA because the weather was barely above minimums. At the completion of his dead-stick GCA the only comment was that the final controller's corrections were too large. I, personally, feel that such skill (or luck) is beyond most of us and I would have ejected. Only you can make such a decision.

Fortunately the picture is not at all bleak. There is a low premium insurance policy available to all of us: *Know your equipment and know your limitations.* One has a definite effect on the other. The more familiar you become with your machine the more confidence you gain in your ability to cope with a sticky problem. If you have the feeling that the situation is out of hand you

can bet your last dollar (you might as well), it is. Don't let pride take you down the drain. Believe it or not, some situations ARE beyond anyone's control. The ones that really give us trouble are the border line cases. If the engine blows and the aircraft is engulfed in flame there is no doubt about what to do. But if it flames out at altitude with a fair chance of gliding to a runway we very possibly will give it a go. This is the kind of emergency that demands we know our bird. How far will it glide? Is the weather good enough to attempt a flameout landing? Is the runway long enough? And, most important, if things don't look good have we established an altitude for leaving the machine? In many instances, ejections that occur outside the capability of the system didn't have to happen. The pilot put himself there by delaying his decision to eject.

We're going to lose some pilots in 1971. The cause will be stated simply: "the pilot delayed his decision to eject until successful operation of the ejection sequence was impossible." This implies several conclusions, most important of which is that it was possible for the pilot to have ejected within the safe envelope.

The intent of this article is not to encourage you to fly with one hand on the ejection handle. Far from it. We must do everything possible to get our sick bird back on the ground in one piece. However, we have had enough sacrificial attempts to save an obviously hopeless situation, with the result that both pilot and aircraft were lost. An aircraft is replaceable—you are not—not to the Air Force, not to your wife, not to your children or to your parents. Don't let your final thought be "I've stayed with the aircraft too long" and become a 1971 statistic. ★

TABLE 2
EJECTION FATALITIES 1963-OCT 1970

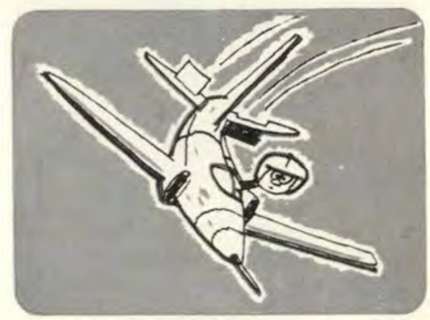
SPEED AT EJECTION KIAS

ALTITUDE ABOVE GROUND LEVEL	0	1-49	50-99	100-149	150-199	200-249	250-299	300-349	350-399	400-449	450-499	500-549	550-599	N/A	UNKNOWN	TOTAL
UNKNOWN					1						1	1			20	23
40,000-49,999															1	1
25,000-29,999							1								1	2
20,000-24,999							2	2	1							5
15,000-19,999						1	1									2
10,000-14,999						2									1	3
5,000- 9,999				1	1			1	3		1		1		3	11
4,000- 4,999						2		1				1				4
3,000- 3,999							1									1
2,000- 2,999				1		2		1	1	1						6
1,000- 1,999					2	1	2		1			5			3	14
BELOW 1000 FT NOT SPECIFIED				1			1								3	5
500-999				2	1	1	1	2		1		1			1	10
250-499				2	6	4		1	1	1	2				3	20
100-249	1		2	7	3	8	3	1		1					7	33
1-99		1	4	6	15	5		1		1	1				9	43
GROUND EJECTION WCS				1												1
GROUND EJECTION NWCS	5	1	3			2								1	3	15
TOTAL	6	2	9	21	29	28	12	10	7	5	5	7	2	1	55	199

Revised 23 Oct 1970

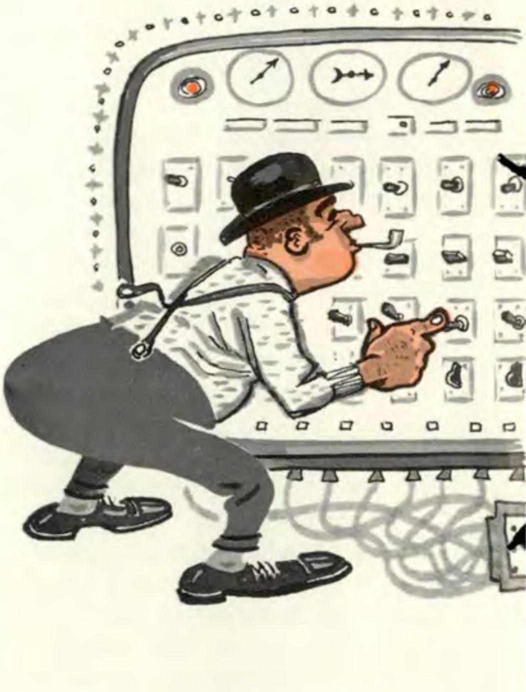
that master mixer Murphy II

Just about everybody by now has heard of that peripatetic Irishman —Murphy. He hangs around the maintenance complex and fouls things up right and left, if the troops don't watch out. What you may not realize is that there is another Murphy. He's a second cousin to the one we all know and he has his own specialty. For sake of identification, let's call him Murphy Two.



The original Murphy (Murphy One) got into the business way back when. It's even rumored that he helped the Wright brothers bust up one of their early birds. Seems he sneaked into the bike shop and reversed the flight controls. As time went by he found more opportunities, and as he gained experience he really got a reputation.

Meanwhile, Murphy Two joined the act, but he specialized on the cockpit. He figured that pilots probably would have so many other things to think about that they wouldn't complain, and that, besides, his work would provide them with a ready-made *out* when they goofed. Good thinking, Murph.



There wasn't much work for Murphy Two for a number of years, but when we started adding such goodies as retractable landing gears, external tanks, wing racks for external stores, drag chutes and tail hooks, Murphy Two was there to meet the challenge.

As Murphy sees his job, it's something like that of his cousin— he tries to beat the designers at their game. And he excels. For ex-

ample, he talks a designer into placing two identical switches, operating different systems, side by side. Murph thinks it's real funny when a pilot gets the wrong switch—like when the backseater in a two-seat fighter attempted to turn on the identification light switch and instead got the canopy jettison switch. It was a cold ride home but Murph didn't care.

He's also very good with handles. He started out by mixing up the gear and flap handles. That was good for years. But the real fun came when airplanes came out with drag chutes and tail hooks. This provided almost infinite possibilities. For example, he has seen to it that pilots have got hold of the gear handle instead of the drag chute handle during the landing roll. This is a bit disconcerting to the pilot, but not any more so than when he goes the other way and gets the drag chute handle on final instead of the gear. Some canopies have emergency jettison handles and pilots occasionally mistake one of these for the gear handle. When this happens there's no doubt in the pilot's mind that he goofed, but that doesn't protect property or persons below.

So many tanks and other external stores have been inadvertently jettisoned that we won't even bother to count them all. They've been punched off on the ramp and in the air. For a bit of a refinement, pilots have mixed up their switchology and, on a rocket pass, dropped bombs. This comes as quite a surprise but probably not as much so as when rockets go instead of bombs. Both events are on record—many times. Ol' Murph Two just grins and tells the bartender to set up another round.

Now, as we said before, Murphy Two really knows the aircraft systems, probably better than most pilots. It's this knowledge that enables him to fool them into doing the wrong thing. Although it couldn't be definitely proven in one case, it is very possible that Murph was responsible for wiping out a couple of fighters just this past year. Somehow or other he got the pilots to use the wrong switch and cut off their fuel during a critical moment. The fact that these tricks sometimes cost pilots their lives doesn't bother Murphy a bit.

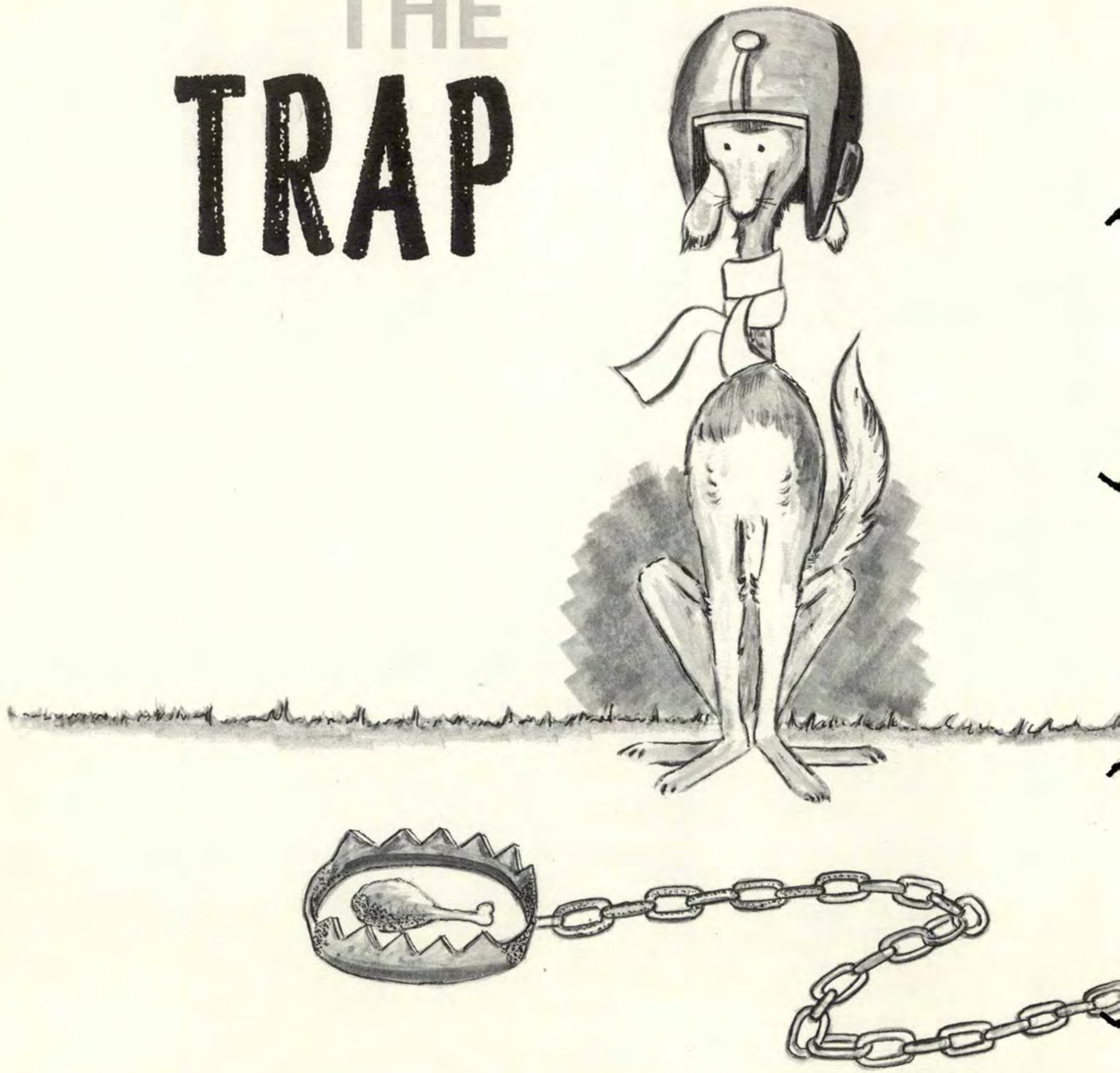
Of course, Murphy Two, like his cousin, doesn't always work alone. He is not a bit selfish about sharing the glory. He exhibited this trait when he cooperated with some others in getting a pilot to eject from a fighter. In this case the throttle stuck at 95 per cent. The pilot flew around awhile burning off fuel, then attempted a landing. He was pretty hot on touchdown, what with the engine running that fast, and he tried to shut down by turning off the fuel master switch. No luck. So the jock thought fast and made a go around. But he didn't have enough fuel left and the bird flamed out. The pilot ejected. The pilot also bought the accident, but we can't help but think that Murphy Two had a hand in it, because the system had been modified to require activation of the fuel shutoff switch for shutdown and no action had been taken to assure that all the pilots knew about the TO.

And so it goes. Murphy Two was last seen doing business at the same old stand and prospering mightily. Asked what his biggest problems were, he replied, "Two. Designers who make it virtually impossible for the pilot to actuate the wrong switch or handle, and pilots who are intimately familiar with all the switches, knobs and handles in the cockpit and who make sure they get the right one.

"There are quite a few of those around, but there are enough of the others to keep me in business for a long time," Murphy says. ★

DON'T SPRING THE TRAP

One thing about smart pilots—read smart people of all occupations—is that they are willing to learn from others. And that brings us to one of the purposes of this magazine: to spread the word so that some of us can avoid the pitfalls that trapped others. All of



which is by way of setting the stage for the following.

A couple of jocks the other day fell victim to one of those days that Jimmy Durante used to describe as the kind when he should have "stood" in bed. They filed for 2 plus 20 enroute with 2 plus 45 fuel on board. After takeoff in their T-Bird they were held to 5000 feet for 15 NM then cleared to FL 250. Above that winds were significantly stronger, which necessitated the 25,000 flight level.

First indication of trouble occurred when the fuselage low level light came on with the fuel counter reading 260 gallons. They did a little figuring and came up with 200 gallons remaining—60 gallons less. After some more computing they figured they could make Base X, using an enroute descent, with 80 gallons remaining.

At 50 miles from Base X the fuselage low level light came on again and they declared an emergency with the center, requesting a straight-in. Then the vise began to tighten. Base X would be closed for at least 15 minutes with a bird in the barrier. There was an out—the nearby international airport. But they were vectored to an extended final to permit another aircraft on minimum fuel to land. When they finally got on the ground the bird flamed out as they approached the chocks.

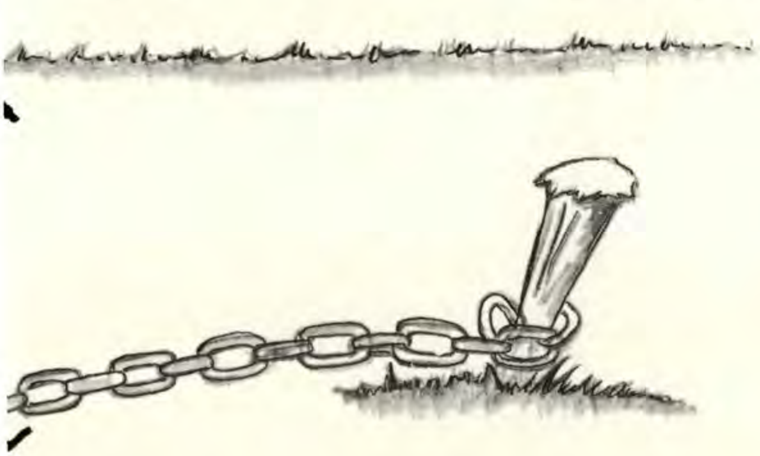
Maintenance found that a boost pump had failed, trapping about 65 gallons in the right wing main tank.

This crew certainly had the deck stacked against them—the boost pump failure, aircraft in the barrier and delay behind another aircraft with minimum fuel. However, back when they first suspected something was wrong, they could easily have made it into either a large civil airport or an Air Force base.

Perhaps another thought here. The runway at Base X was closed with an aircraft in the barrier, but the runway is over 13,000 feet long. It would seem that in an emergency the T-Bird could have been landed the other way or over the bird on the runway.

Just a few days prior to the event described above, another crew lucked out when they were involved in what nearly became a tragedy of errors.

The right fuel quantity gage on their T-29 had been inoperative for nearly three months so fueling the bird required a certain amount of guesswork. At an away-from-home base they took on 6600 pounds, assuming, because there was 4500 pounds in the left tank, that there was an equal amount in the right tank. They departed next morning at 0900, flew for an hour and one-half and landed at another base. After shutting down for 20 minutes they took off again and headed for a base near home.



About five hours later, as they were descending through 7000 feet, there was a pull to the right, with low fuel pressure reading and surging rpm on the right engine that continued to drop. They shut down the right engine, thinking possibly that side was out of gas, but not being sure because the gage couldn't tell them. The decision was to try to restart the right engine with fuel from the left tank. Crossfeed was selected and the right engine restarted at 2500 feet, but as power was advanced the rpm began to surge so it was shut down again.

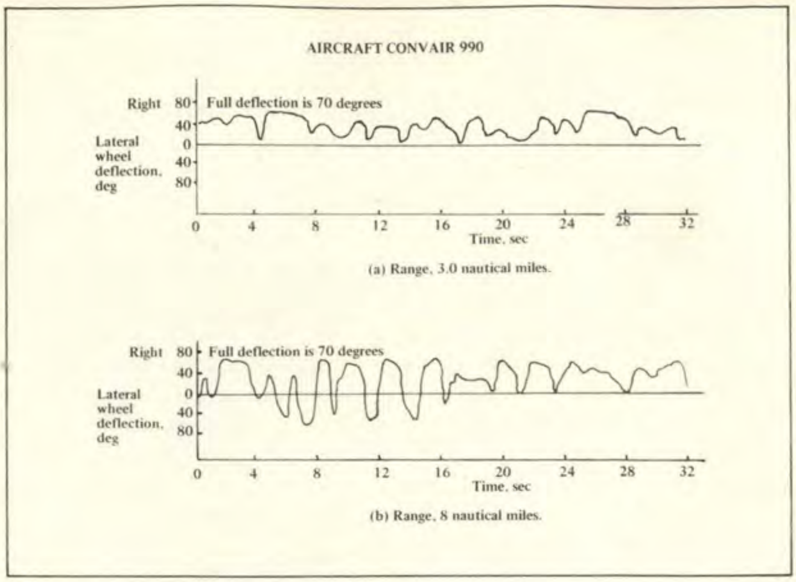
The pilot now asked for radar vectors to a military base and was given a turn. While in the turn the left engine began to backfire. With the situation getting stickier every moment, the pilot spotted a lighted runway beneath the aircraft and made an emergency landing.

Although it could not be definitely proven, it was suspected that carburetor ice caused the left, and possibly both, engines to run rough. The flight engineer had shut off the carburetor heat at 10 to 12°C carburetor air temperature prior to descent.

Both of these events were classified incidents but how easily they could have wound up in the *accident* category. Both of them had something in common with so many aircraft accidents: multiple factors, each of which could and should have been better handled. In the case of the T-29, maintenance got into the act for not repairing the fuel gage when they had the capability.

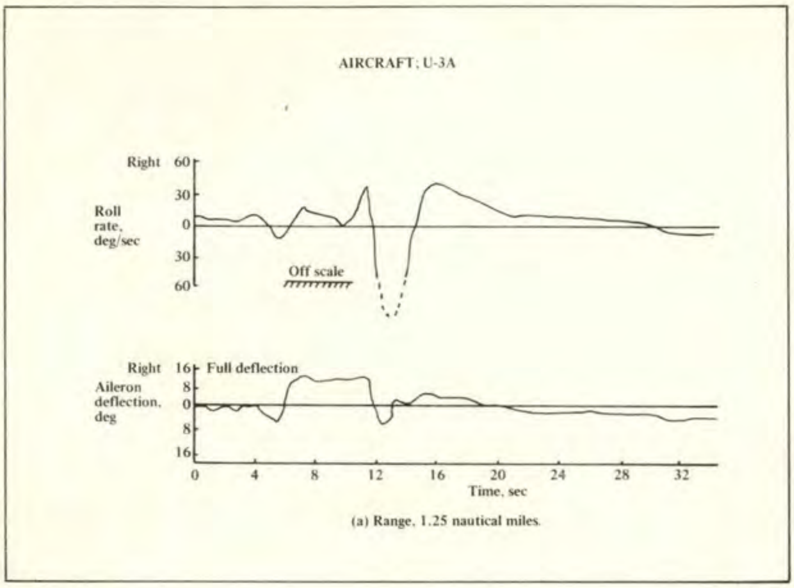
A malfunction of an aircraft component is like a trap. Ever watch an animal approach a trap? He's wary, suspicious and very careful. But if he's very hungry, he may take a chance. Bang! We make the same mistake sometimes when the urge to press on causes us to spring the trap.

Don't do it. ★

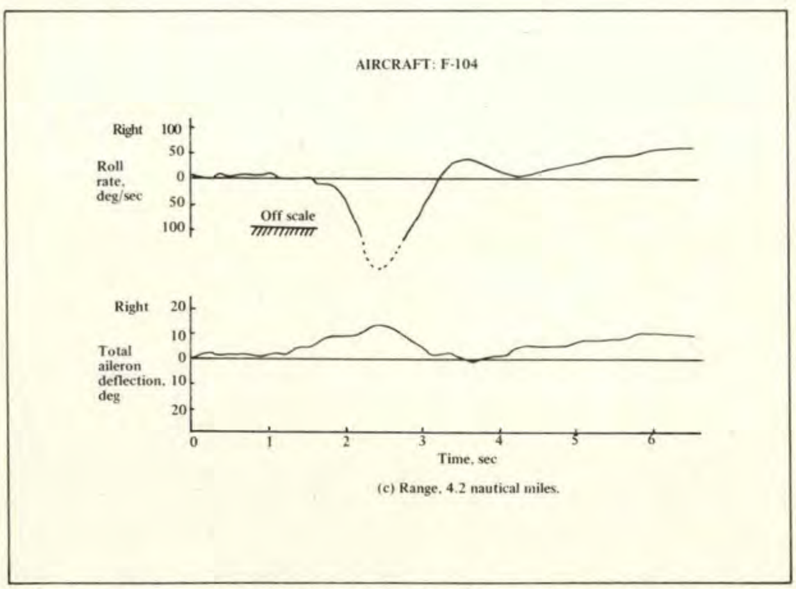


(a) Range, 3.0 nautical miles.

(b) Range, 8 nautical miles.



(a) Range, 1.25 nautical miles.



(c) Range, 4.2 nautical miles.

Convair 990 probing wing vortex of C-5: airspeed—250 kts. C-5A: airspeed—175 kts, altitude—12,500 ft, gross weight—496,000, clean configuration. U-3A: airspeed—140-160 kts in B-52 wake. F-104: airspeed—250-300 kts in C-5 wake.

W
TUR

Last September a T-38 aircraft on final approach flew into the trailling vortices of a 707 that had executed a go around on a 30 degree bisecting runway. The T-38 pilots were unable to maintain control and were fatally injured in the ensuing crash. The cause was wake turbulence.

One thing about wake turbulence that all pilots should know and appreciate is that roll rate capabilities of all short span aircraft can be exceeded when flying in the vortex of large aircraft.

Both NASA and FAA have been conducting tests in which probe aircraft have obtained wake turbulence data by traversing heavy jet wakes. One of the problems encountered by the probing aircraft was to remain within the wake. The control deflections required to resist ejection from the wake provide a measure of the energies encountered (see charts at left):

- A pilot in a CV 990 used 40 degrees of the available 70 degrees of wheel deflection to maintain control three miles behind a clean configured C-5 at 170 knots. The Boeing 747 vortex generated roll rates of 22 degrees per second, from three to eight miles behind the aircraft, and required the maximum Convair wheel deflection to remain in the wake.
- A Lear jet rolled nearly 120 degrees in one and one-half seconds while flying 3.7 miles behind a C-5.

AKE
BULENCE

Vernet V. Poupitch, Directorate of Aerospace Safety

• A Cessna U-3A at 140 to 160 knots probed the wake of a B-52 grossing 252,000 pounds. At 1.25 mile separation, the Cessna pilot was unable to prevent the airplane from being rolled out of the vortex even though he used full aileron control! The peak roll rate was 90 degrees per second! At five mile separation, the normal acceleration varied from −0.7G to +2.5G. With inadvertent adverse inputs to the elevator when crossing the wake of a heavy aircraft, wing failure will surely occur on a lightplane.

• An F-104 at 250 to 300 knots penetrated the C-5 wake. A roll rate of 170 degrees per second was recorded! On several occasions dur- this type of vortex penetration, the F-104 was actually thrown from the wake and large excursions in airspeed and altitude resulted.

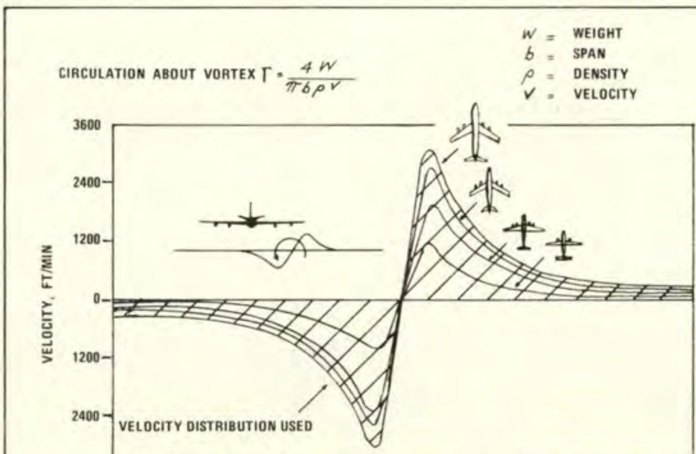
The wake turbulence hazard should not be underestimated. FAA reports 158 general aviation aircraft accidents between 1964 and 1969 where vortex turbulence was a cause factor. One analysis by the National Transportation Safety Board indicates that, where vortex turbulence was a cause factor, 50 per cent of the civil aircraft accidents occurred during landing, 30 per cent during takeoff and 20 per cent while enroute. From this it appears that wake turbulence is most hazardous to aircraft landing and taking off.

Wake turbulence is not easy to identify, according to a survey of experienced USAF fighter, bomber and cargo pilots, and Flight Test Center and NASA test pilots. The objective was to determine if wake turbulence could be distinguished generally from other atmospheric phenomena such as sloping jet streams, wind shear and weather related turbulence. By a large majority, the pilots replied in the negative. Hence, to distinguish wake turbulence from other atmospheric phenomena, without electronic wake detection systems, does not appear to be feasible.

As larger aircraft are introduced, vortex intensity will grow in magnitude and prevalence. Imagine fixed wing aircraft that weigh one million pounds—we will soon be there. To further complicate the pilot's task, more and more helicopters are operating over runways used by fixed wing aircraft. So we can look forward to more turbulence and more exposure to the vortex hazard.

Results from flight tests, theoretical analysis and operational experience have shown that vortex encounters can be destructive, not only to all short span aircraft, but also to those grossing as much as 175,000 pounds. Therefore, wake turbulence is of concern to all major commands.

To cope with wake turbulence it is logical to first learn something of its characteristics so that you can steer clear of trouble. You are, by now, familiar with the size and velocities of the vortex, and you



Envelope of calculated maximum velocities in one vortex of some large transport aircraft

WAKE TURBULENCE Continued

may know that the intensity increases directly with the weight for the same aircraft. Also, among aircraft of equal weight and velocity, the shorter span vehicle will generate the greater vortex circulation. Similarly, any vehicle at the same weight will generate greater circulation at slower airspeed. Experiments have determined that the region of peak velocity in the vortex is at a radius of approximately eight per cent of the wing span from the vortex center. Beyond this, the velocity decays rapidly. Hence, if the vortex were visible, we could at least steer clear of the most dynamic portion. We may soon learn how to do that.

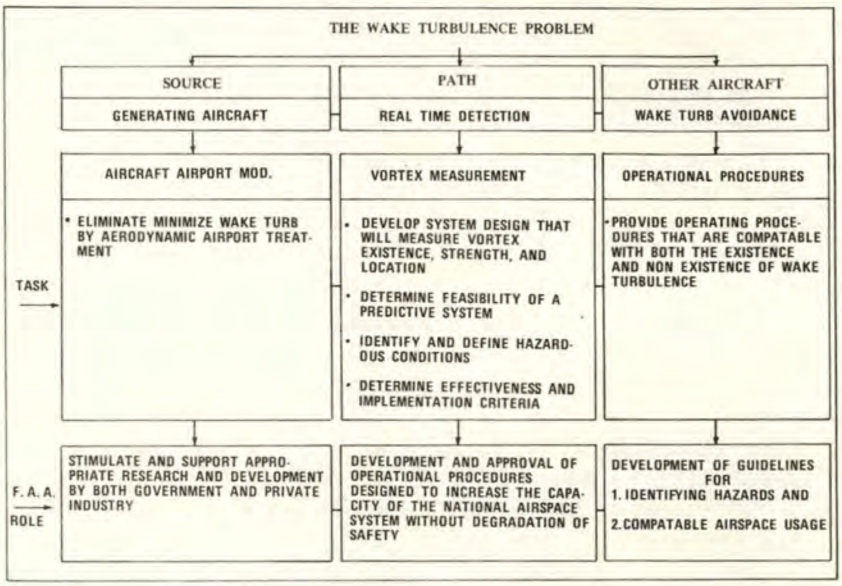
Last October, FAA proposed an ambitious and timely R&D program on wake turbulence with the objective of increasing usable airspace by eliminating or minimizing the effects of wake turbulence. The first step would be a modification program to eliminate or minimize wake turbulence by airport aerodynamic considerations. The second step, selection of a system with real time detection capability to measure vortex existence, strength, and location. Finally, provision of operational procedures compatible with both the existence and non-existence of wake turbulence.

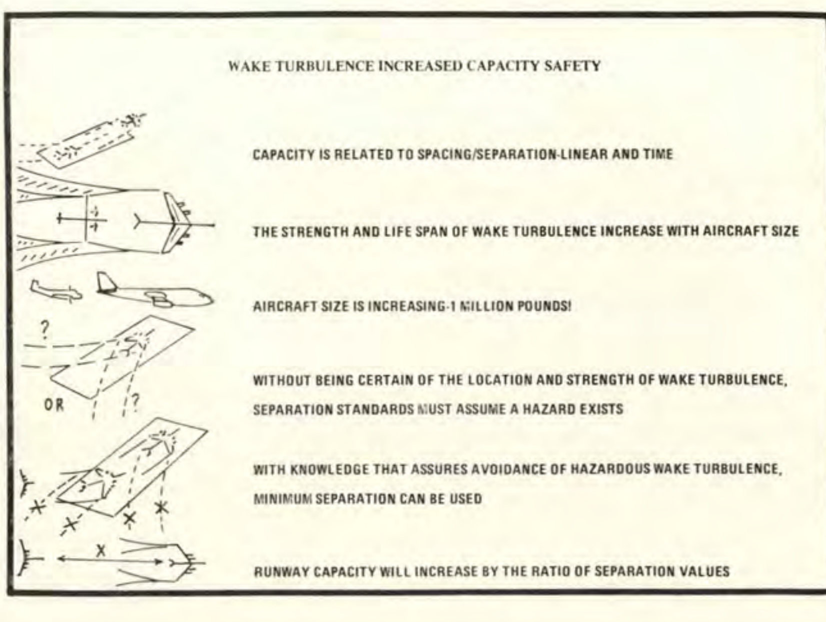
Presently, without being certain of the location and strength of wake turbulence, air traffic control must assume a hazard exists. However, with knowledge that can provide the capability to avoid hazardous wake turbulence, minimum separation can be used.

A wake turbulence measurement system is under development. It might be based on laser devices, accoustical or millimeter radar or infrared systems. Detection might be by emission of non-pollutant particulates by the generating aircraft.

Meanwhile, until we have sensing systems, we must acquire and retain respect for wake turbulence and maintain our separation standard of ten miles and four minutes. Ultimately, a solution will be found and we can look forward to a reduction of separation standards.

(For further information, we recommend ALSAFECOM 21/70 and the film "Wake Turbulence," TF 6568.) ★





OOPS

"Okay, Lead—hit my pods!"

When something that isn't supposed to fall off an airplane does, it's usually because the gadget that was holding it on broke. But friend, the data for that remark was contained in a mighty thick computer run-off, and even though the instances of pilot/maintenance/load crew error represent a minority, it's a pretty hefty minority.

We can do a lot to prevent an inadvertent jettison, right there where the muscle bends the wrench. Imagine an error, and it's been made: over-torquing of supporting bolts, improper wiring, sloppy soldering, inadequate inspection, hasty preflights—the list goes on and on. But it boils down to this: in too many instances, the mechanic shortcuts, ignoring the aids designed to help him, and the inspector places an unfounded trust in the integrity of the mechanic. For example:

A flight of four F-100s was on an air-ground range mission. After practicing rocket delivery, they set up for high-angle bomb delivery. On his first pass, Nr 2 inadvertently jettisoned his B-37K1 bomb rack. About three minutes later, the same thing happened to Nr 4. Inspection showed that, in each case, the live pylon impulse cartridge had been inserted in the aft cavity and the dummy cartridge had been inserted in the forward cavity—exactly backwards from the checklist instructions. A supervisor observed the loading and signed off the red cross, but evidently no one had a checklist.

In another case, the pilot hit the starter button with one hand, punched the clock with the other hand, and pressed the SALVO button with his little finger, leaving his stores sitting on the ramp. He was helped along, however, by an eager crewchief who anticipated the checklist and pulled the pins early.

Good maintenance is the backbone of our operational capability, but slipshod, shortcut maintenance can break that back. Any mechanic knows the value of using the proper tools for a job. One tool that's proper for every job is a checklist. Use it! ★

PILOTS —

Meet AiMS

Maj L. S. Franscini, ASD, Wright-Patterson AFB, Ohio

The AIMS modification is being installed in increasing numbers of USAF aircraft. Target completion date is 1 January 1973 for all aircraft in the inventory. Several AIMS prototype aircraft will be in the inventory as one-of-a-kind aircraft for several months prior to fleet modification and TO update. Interim data is being supplied with these aircraft but general distribution is not being made. As a result many aircrew members have probably never heard of AIMS or think "missile" when they hear the word, even though several hundred AIMS equipped aircraft are now flying. Hopefully, at least enough information will be presented here so that complete ignorance of the subject will not exist when you first encounter an AIMS aircraft.

The AIMS Program is the DOD implementation of the FAA improved Air Traffic Control Radar Beacon System (ATCRBS) and the military Mark XII IFF System. This brief article will describe these two functions as they apply to aircrews and describe some of the obvious aircraft changes which identify the AIMS modification.

The ATCRBS portion of the AIMS modification is to update USAF transponder equipment to meet the new FAA air traffic control requirements. For several years now, air traffic controllers have been issuing Mode 3 code instructions in 4 digits, the last two being zero. This was a preliminary to expanding Mode 3/A code capability (Mode 3 is military designation and Mode A civil designation for traffic control mode) from the present 64 codes to 4096 codes. Both FAA and military interrogators are presently being converted to the expanded capability. If you have flown in the New York, Washington, Atlanta, Jacksonville or other terminal areas you may have heard controllers requesting squawks on codes where the last two digits are other than zero from airline traffic.

In addition to the expanded Mode 3/A code capability, an additional mode (Mode C) for automatic altitude reporting is being added. The final configuration of the FAA and military ground radar sites will include automatic processing equipment which will display a discrete code and altitude alongside each radar blip, eliminating the need for voice contact for positive identification and altitude reporting (Figs. 1 and 2).

The AIMS program is providing the airborne equipment required in all Air Force aircraft. A new AIMS transponder with expanded Mode 3/A and Mode C capability is being installed in addition to an altitude source for Mode C. The most obvious cockpit change in an AIMS modified aircraft without vertical scale flight instruments is a new altimeter display (Fig. 3). The counter-drum-pointer display is a great improvement over the three pointer displays now in use and is a fringe benefit of the AIMS program.

In high performance aircraft the AIMS altimeter is the AAU-19/A which is identified by a standby-reset switch on the bezel. This altimeter is a servo-pneumatic device. In normal operation it will be in servo mode and will receive its input from an AIMS altitude encoder-computer or the aircraft CADC. In the event of a servo link malfunction, the failure monitor in the altimeter will automatically switch to standby and operate as a purely pneumatic instrument. A flag on the instrument face appears in standby mode. This design eliminates the requirement for a standby altimeter, required for most servo altimeters. The aircrew checklist will direct that the altimeter be switched to servo mode by placing the standby/reset switch to reset prior to takeoff so that the aircrew reads the same altitude as is being transmitted to the ground. In the servo mode the altimeter is more accurate because its inputs are corrected for Mach by the encoder-computer.

The Air Force has required a maximum altitude system error of ± 250 feet up to 50,000 feet for the AIMS altimetry system. This is a far tighter tolerance than has existed in the past. (Note: Before all the pilots raise their personal minimums, the ± is at cruise altitudes. In order to meet this requirement the accuracy in the approach altitude and airspeed regime is much better, on the order of ± 20 feet).

If during the mod period you get an AIMS modified aircraft and your wingman does not, there may be large differences in indicated altitude. This may be true in either standby or servo mode, for improved static systems are being installed in many aircraft to meet AIMS requirements. The AIMS altitude is the best one.

The method of applying the altitude correction may produce some conflicting indications between the altimeter and vertical velocity during accelerations and decelerations in aircraft that have a large static pressure error. This disparity occurs because the altimeter is corrected and the vertical velocity is not. When aircraft speed is changing, the instrument static pressure error is changing so that, if the change is large, as in some aircraft (e.g. B-52, F-101), the vertical velocity may indicate a change while the altitude computer corrects the error and holds the altimeter reading constant. This phenomenon occurs only in the speed range where the static pressure defect curve has a steep slope and the aircraft is changing airspeed at a fairly rapid rate. This instrument discrepancy presents no problems in aircraft control if the pilot is aware of what is happening and ignores the false indications on the vertical velocity when speed changes are made.

The altimeter in lower performance aircraft is the AAU-21/A altimeter-encoder. The display of this altimeter is the same as the

Figure 1. Present ground controller's scope display

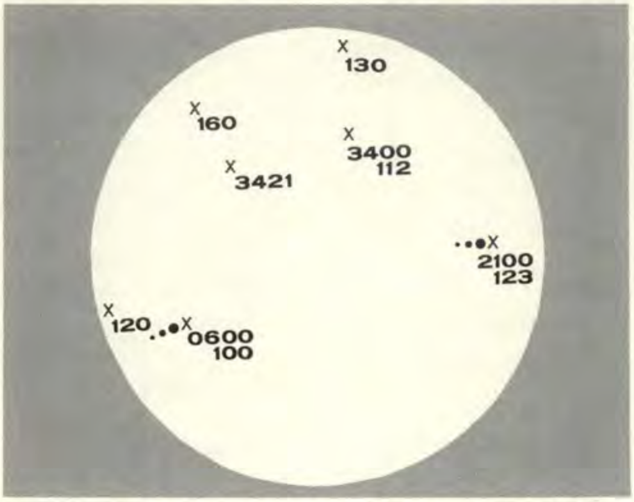


Figure 2. Future ground controller's scope display

AAU-19/A, but there is no standby/reset switch. The altimeter has a "code off" flag which monitors only the coder function of the altimeter. It is possible to fail to report altitude without the "code off" flag showing, in case of transponder failure or improper transponder control settings.

The other obvious change in AIMS modified aircraft is a new transponder control (Fig. 4). The functions of the old IFF and SIF controls have been combined into one box and the additional AIMS functions have been added. The most apparent change is the addition of the last two digits to the Mode 3/A selector and the conversion from rotating knobs to thumb wheels.

Aside from the Mode 4 section of the control which will be discussed later, a couple of other goodies have been added. There are four mode select switches in place of the old two. There is now a Mode 1 switch and a Mode C switch in addition to Modes 2 and 3/A. These switches are now three position switches, with a momentary test position. In aircraft with built-in test capability (TS-1843 or similar capability), positioning one of these switches to the test position will light the test light if that mode is operating properly. An additional three position test switch is also provided. In aircraft with built-in test capability, positioning of this switch to MON position will light the test light at any time the transponder is interrogated and replies. The RAD TEST position is for maintenance use and enables the transponder to reply to special test interrogations. The Master switch and Ident/Mic switch are similar to the old control. Position-

Figure 3. Altimeter, servoed, counter-drum-pointer, AAU-19A.

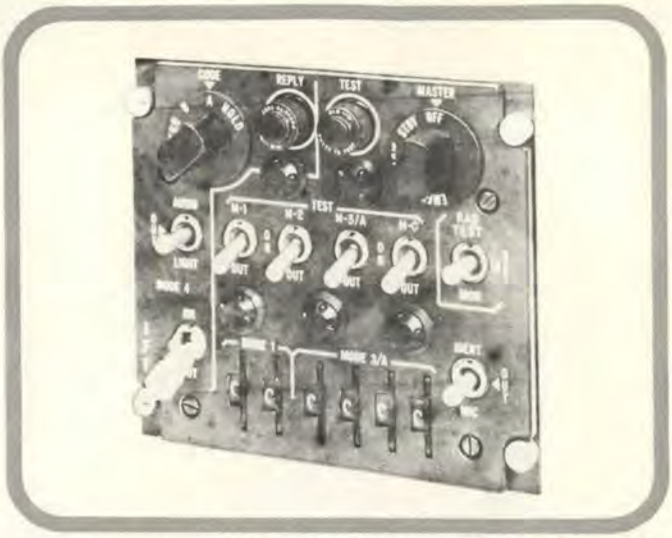


Figure 4. Modified transponder control panel.

ing the Master switch to Emergency automatically squawks civil emergency (Mode 3/A Code 7700) as well as Military emergency. The Master Switch must be pulled outward to turn to emergency position.

The Mark XII IFF portion of the AIMS mod is to provide a secure IFF capability, Mode 4, for military aircraft. This capability is provided by an airborne cryptographic computer which generates coded replies in response to valid interrogations generated by an interrogator cryptographic computer. A keying device, inserted into the computer by maintenance personnel prior to flight, sets two codes, one for the present code period and one for the succeeding code period. Most aircraft are receiving the mounting and wiring provisions for this capability but at the present time the computers are not being installed.

When the Mode 4 computer is installed the aircrew must be aware of the procedures to retain or drop the code after maintenance personnel have inserted it in the computer. The Mode 4 controls on the transponder control consist of a mode select switch similar to the other mode select switches, except that this switch is guarded to the ON position and has no test position. There is also a rotary code switch with ZERO, A, B, and HOLD positions. The ZERO and HOLD positions are momentary and the knob must be pulled outward to turn to the ZERO position. The A position selects the code for the period in which the key was inserted and the B position, the code for the following period. The HOLD position is used after landing to hold the code if another flight is anticipated in the same code period.

When the code is first inserted it is in a "mechanical hold" mode. When the gear is retracted after takeoff the computer switches to "electrical hold" (Fixed gear aircraft will have a cockpit switch to change from mechanical to electrical hold). If the Transponder Master Switch is turned off or aircraft power is interrupted for "five" (5) seconds while in electrical hold the code will zeroize. When the aircraft is on the ground the HOLD Switch position will put the computer back into mechanical hold.

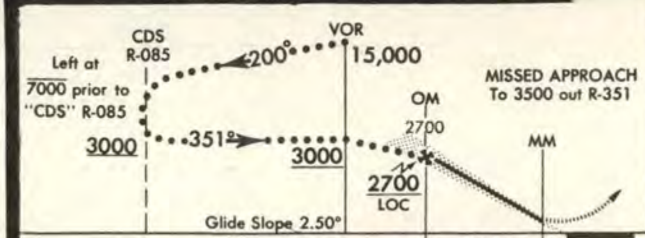
The after landing check on Mode 4 equipped aircraft will require going to the HOLD position for 15 seconds prior to turning off the transponder, if retention of the code is desired. The ZERO position will zero the code anytime it is selected with power on.

The third Mode 4 control is a monitor switch which has AUDIO, LIGHT and OUT positions. The audio position puts a tone in the pilot's headset when the transponder receives Mode 4 interrogations. The light position lights the reply light on the control panel when Mode 4 replies are being made. In addition, an IFF caution light is installed in the cockpit, which lights when valid Mode 4 interrogations are being received but no replies are being generated.

From the aircrew point of view, the AIMS program means a new transponder control and possibly a new altimeter and static system. Aircrews flying those aircraft which have had new static systems installed as part of the AIMS Mod should be aware of the new position error. Operation of the new transponder is essentially the same as before except for the Mode 4 codes. After 1 January 1973, the FAA will require 4096 Mode 3/A codes and automatic altitude reporting for operation above 10,000 feet MSL and in certain terminal areas. For operations in this environment transponders will be set to discrete Mode 3/A codes directed by the controller, much as discrete radio frequencies are issued today. These discrete codes coupled with the automatic altitude reporting will greatly reduce the number of voice transmissions required and improve Air Traffic Control service. ★

THE I.P.I.S. APPROACH

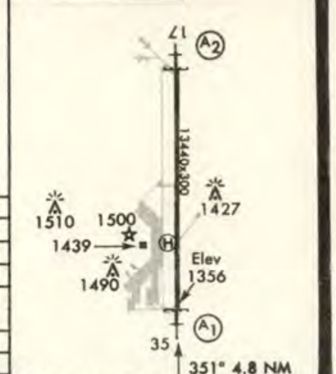
By the USAF Instrument Pilot Instructor School; (ATC) Randolph AFB, Texas



CATEGORY	C	D	E
S-ILS-35	1556/24 200 (200-½)		
S-LOC-35	1660/24 282 (300-½)		
CIRCLING*	1820-1½ 442 (500-1½)	1920-2 542 (600-2)	
VOR	NOT AUTHORIZED		

OM to LOC-Missed Approach 4.8 NM					
Knots	120	140	160	180	200
Min: Sec	2:24	2:03	1:48	1:36	1:26

FIELD ELEV 1378



HIRL avail Rwy 17-35

351° 4.8 NM From OM

Q Assume you are flying the above ILS approach and fail to start timing at the OM. In the event you lose your glide slope indicator, can you continue the approach to "LOC" minimums, and when would you execute a missed approach, if necessary?

A We know of no reason why you could not descend to "LOC" or circling minimum and continue the approach in the event you lose the glide slope indicator. A missed approach should be initiated at the MM if the runway environment is not in sight or a safe landing cannot be made. The missed approach point (MAP) for a "LOC" approach is normally at the end of the runway; however, using the MM as the missed approach point (MAP) would provide a safe margin for a missed approach or allow a reasonable opportunity for a safe landing. The IPIS recommends, as technique, that timing always be initiated at the OM on an ILS which provides a "LOC" minima and timing information.

CATEGORIES

Q Can I fly a lower category approach, for example: Category E, fly Category D approach?

A No. TERPS (AFM 55-9) recognizes the differences in aircraft performance. These differences have a direct effect on the *airspace* and *visibility* needed to perform certain maneuvers such as circling approaches, missed approaches, corrections on final approach, and descent. This varying performance is reflected by placing aircraft in categories based upon maximum authorized landing weight and/or approach speed. TERPs requires aircraft approach category operating characteristics be used to determine turning radii, minimums and obstacle clearance areas for circling and missed approach. The main difference in obstacle clearance criteria is in the circling approach area. For example: Category E requires nearly twice the area as a Category D. Also, visibility minimums normally differ according to categories. Lower category approaches (Category D, fly Category C approach) may not provide sufficient obstacle clearance or the necessary visibility requirements to safely maneuver for landing.

NON-PRECISION APPROACHES

Q If I am radar vectored to the ILS Final Approach Fix (FAF) and fly an ILS, can I log a non-precision approach for the radar vector in addition to a precision for the ILS?

A AFM 60-1, dated 22 Sep 70, defines an approach as "that segment of flight that *begins* at a *final approach fix* (FAF) and ends at a missed approach point (MAP)." With that definition in mind, *any* maneuvering up to the FAF cannot be logged as a non-precision approach.

RADAR MONITOR

Q What information is furnished by the radar controller on a radar monitored ILS?

A The radar controller will issue the following advisories to the pilot during a radar monitored ILS approach: (1) Over the FAF (normally outer marker), (2) exceeding runway alignment and glide slope safety limits, and (3) passing middle marker or the point where the glide slope intercepts 200′ elevation, whichever is nearer the end of the runway. The last advisory (MM or 200′ glide slope elevation) will consist of the following terminology: "Radar Service Terminated." Since this is advisory information, you can continue to the DH as indicated on your altimeter. However, be aware that the "Radar Service Terminated" statement by the radar controller indicates you are *very near* the missed approach point. ★

Ops topics

"BENDS" (LIKE DROWNING) CAN BE FOREVER, TOO

Last October the copilot of a T-33 experienced an unprogrammed review of his symptoms of bends. The T-Bird was cruising at Flight Level 350 with a cabin altitude of 24,500 feet. After 35 minutes of cruise, events followed this sequence:

1. The copilot felt a "tingling" sensation in his knees, increasing over a period of ten minutes to a state of severe pain.

2. Assuming he had the bends, the copilot selected the "safety" position on his oxygen regulator.

3. Elbow pains developed, and the pilot noted that the copilot's breathing was "heavy."

4. A descent was begun 65 minutes after level off (30 minutes after the onset of symptoms of the bends).

5. During the descent, "It burned to breathe, like inhaling a cigar." However, no chest pains accompanied this sensation. Oxygen pressure was noted to have decreased to 50 psi.

The landing was uneventful, but one hour later the copilot experienced a headache, nausea, and gray, mottled vision. He was admitted to the hospital where the symptoms disappeared after he breathed oxygen for two hours. Fortunately, no permanent brain damage resulted.

An additional problem was a loose ("comfortable") oxygen mask which WAS NEVER TIGHTENED after the first symptoms developed. Hypoxia on top of bends is enough to make the physiological training troops weep! This man was very, very lucky.

The failure of the pilot to declare an emergency and descend immediately is astounding. He listened to the copilot's heavy breathing for 15 minutes before he requested an ARTCC clearance to divert to a nearby base. Then he WAITED FIVE MORE MINUTES for the clearance to be issued! Incredible!

How many other old heads, who look upon the triennial altitude chamber training as a bind, have forgotten the symptoms of bends? Lectures can be boring, but *your* life is the subject under discussion. Review and remember all the symptoms of bends. As soon as one appears in flight, that is the time to take action. If the onset is mild, a lower cruise altitude may be all that you need to relieve the symptoms, but you should still land and be examined as soon as practicable. If you suddenly realize that someone has several symptoms, an emergency descent to the nearest suitable air patch is mandatory. ★

Maj Dave Hook, CAF
Directorate of Aerospace Safety

KEEP 'EM HIGH

A "Keep 'em High" procedure aimed at reducing exposure between high performance turbojets and smaller, slower aircraft has been announced by the FAA.

Where traffic and operational conditions permit, turbojet aircraft will generally be kept at 10,000 feet or higher until they are within 30 miles of the airport. They then will be kept at least 5000 feet AGL until they reach the final turn-on-descent area and are ready to begin maneuvering for an approach to landing.

The procedure will be in effect at FAA's 119 terminal radar control areas by February 1971, at airport towers without radar by July 1971. November 1971 is the deadline for airports without towers that serve scheduled air carrier flights, and February 1972 for all other airports in the U.S. ★

F-4 ALTIMETER PHOTO

An Ops Topic in the November issue, "How High," page 25, included a photo of an F-4 altimeter with a screw-on cap safety chain obscuring the 10,000 digit. The photo was for illustration purposes only and should not be related to the numbers given in the article. ★

FLIP CHANGES

VFR Low Altitude High Speed Routes: Effective 1 April 1971 procedures for operating on the DOD VFR Low Altitude High Speed Training Routes will be changed. These procedures are already in use within the FAA Southern Region (Southeast United States). Suggest that all pilots, who plan to operate on Low Altitude Routes after 1 April 1971, refer to the textual data preceding the FAA Southern Region route descriptions in Section IIA, FLIP Planning. This information, which currently describes procedures for the FAA Southern Region, will be applicable to all DOD VFR Low Altitude High Speed Training Routes after 1 April 1971. ★

LUCKY PIERRE

An old saying in aviation that goes back many years is "There's always a wire." Meaning that, for some reason, there always seem to be utility wires of some kind off the end of every runway. The Air Force has done a pretty good job of eliminating obstacles in the approach zone, but we don't always know what is lurking out there at civil airports. An F-4 crew recently found out at one airport.

They were instructed to hold for 20 minutes while the runway was being changed at an Air Force base. After holding 15 minutes, with fuel getting low, the pilot elected to land at a nearby civil airport. On final the aircraft cut a power line and grazed three unlighted poles. Fortunately damage was confined to dented leading edge flaps.

Here's what investigators found the following morning: no approach lights, VASI inoperative, obstruction lights on power line apparently inoperative, runway threshold lights so sooted over from jet exhaust they were not visible. Add blowing dust which hampered forward visibility so that all the pilot could see was the runway side lighting.

Call these troops Lucky. ★

THEY WALKED AWAY

While strafing a target in mountainous terrain, the F-4 crew steepened their dive angle on the last pass because of trees surrounding the target. As the guns were firing the GIB called "pull" and the AC aborted the pass and pulled the nose up through the horizon. After landing they found one wing damaged as the result of hitting a tree. Another foot or two? No need to say more on this one, except to say there are a lot of names in the file of guys who flew that extra foot or two lower. ★

Toots

is interested in your problems. She spends her time researching questions about Tech Orders and directives. Write her c/o Editor (IGDSEA), Dep IG for Insp & Safety, Norton AFB CA 92409

Dear Toots

TO 00-20-5, para 1-95, states, "All AF bases will give first priority to servicing and maintenance of Air Evacuation aircraft." MM 66-3, Vol II, para 1-4, Work Priorities, gives air vehicles on alert (including ARRS aircraft) maintenance Priority 1, and it gives Air Evacuation aircraft Priority 2.

Please, will you clarify?

Confused
Andrews AFB, MD

Dear Confused

The priorities as listed in the Maintenance Manuals are correct. Alert and ARRS aircraft receive Priority 1. This is as it should be; if the United States were under attack, the alert force would have to be given Priority 1.

As for rescue aircraft, it makes sense that if they are attempting to rescue someone, they would have priority over air evac, inasmuch as personnel on the air evac are already receiving medical attention as opposed to those being rescued.

Regarding the statement in 00-20-5, para 1-95, the last sentence should be interpreted as follows: air evac should receive first priority of all category two priorities. Perhaps you would like to submit an AFTO 22 suggesting a change to TO 00-20-5.

Toots

Dear Toots

What technical publication gives Quality Control the authority to use colored pencils and/or pens to indicate errors on the AFTO Form 781 series forms maintained in the aircraft jacket file? That is, draw arrows, circles, lines and make written comments on the forms when inspecting the aircraft jacket file.

To my knowledge no authority exists to permit this. Quality Control is required by AFM 66-1, para 7-20, to inspect the Record Jacket File currently with the quality inspection following periodic maintenance. Inactive records must be kept on file for a minimum of 60 days IAW AFM 12-50. To confirm my contention I reference TO 00-20-1, para 2-4, and para 2-8.

CMSgt Walter E. Cartee
165 CAMRON, GA ANG
Savannah, GA

Dear Chief

I have consulted several officers who participate in Unit Effectiveness Inspections and find that there is nothing that prohibits the use of colored pencils or pens to identify errors on the AFTO 781 series forms maintained in the aircraft jacket file. Of course, the marks put on the forms must not obliterate any part of the discrepancy or corrective action making it difficult to read. The marks should also be neat and uniform. The two paragraphs you referred to in TO 00-20-1 are aimed at the maintenance of the forms before they are placed in the jacket file. It is generally felt by those in the know, that identifying form errors is good management practice. Of course, identifying the error is only the beginning; something must be done to prevent personnel from making the same errors again.

Toots

REX RILEY'S CROSS COUNTRY NOTES

For many years, departing most bases under IFR conditions was a painful experience. The ATC clearance was complicated and often involved both high and low altitude charts with little known fixes. A climb on course was something to be cherished but seldom seen unless we were departing Boondocks AFB. Then someone came up with the magic solution. Make all departures from a particular base standard. So was born the SID.

Things have changed, however. Almost every departure is now a radar monitor and a climb on course is more the rule than the exception. Besides, if we do receive a deviation we know big brother is watching and the diversion is most likely in the interest of avoiding one of those air-to-air bashes. As a result of all this good service, some bases have neglected a critical review of their seldom-used but still in-effect SIDs. We flew one the other day that gave a radial for departure; however, it did not specify what facility we were supposed to use. The SID was, and in some instances, is a useful system. If your base still uses SIDs, how about taking a look to see if the departure drawn some six or seven years ago is valid? You might be in for some surprises.

ADDITIONS AND DELETIONS

We have received a lot of mail recently from troops in the field concerning transient services at various bases. Most of it was of a critical nature, I'm sorry to say. However, once in a while we hear from a base that is interested in being evaluated for the Rex Recommends List. In such cases, we make a special effort to stop in and do a complete evaluation. If you feel your base can qualify, and you want the award, let us know. We will have some empty spaces soon so there's plenty of room on the list. ★

THE

REX RILEY
Transient Services Award

LORING AFB	Limestone, Me.
McCLELLAN AFB	Sacramento, Calif.
MAXWELL AFB	Montgomery, Ala.
HAMILTON AFB	Ignacio, Calif.
SCOTT AFB	Belleville, Ill.
RAMEY AFB	Puerto Rico
McCHORD AFB	Tacoma, Wash.
MYRTLE BEACH AFB	Myrtle Beach, S.C.
EGLIN AFB	Valparaiso, Fla.
FORBES AFB	Topeka, Kans.
MATHER AFB	Sacramento, Calif.
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, Tex.
MARCH AFB	Riverside, Calif.
GRISSOM AFB	Peru, Ind.
PERRIN AFB	Sherman, Tex.
CANNON AFB	Clovis, N.M.
LUKE AFB	Phoenix, Ariz.
RANDOLPH AFB	San Antonio, Tex.
ROBINS AFB	Warner Robins, Ga.
TINKER AFB	Oklahoma City, Okla.
HILL AFB	Ogden, Utah
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, N.C.
ENGLAND AFB	Alexandria, La.
MISAWA AB	Japan
KADENA AB	Okinawa
ELMENDORF AFB	Alaska
PETERSON FIELD	Colorado Springs, Col
RAMSTEIN AB	Germany
SHAW AFB	Sumter, S.C.
LITTLE ROCK AFB	Jacksonville, Ark.
TORREJON AB	Spain
TYNDALL AFB	Panama City, Fla.
OFFUTT AFB	Omaha, Nebr.
ITAZUKE AB	Japan
McCONNELL AFB	Wichita, Kans.
NORTON AFB	San Bernardino, Calif.
BARKSDALE AFB	Shreveport, La.
HOMESTEAD AFB	Homestead, Fla.
CHANUTE AFB	Rantoul, Ill.
KIRTLAND AFB	Albuquerque, N.M.

do cold fingers contribute to lost panels?

THE AIR FORCE continues to be plagued with panels falling from aircraft while in flight.

To gain a better insight into the panel loss problem, we called on the computer to give us the statistics for a given period of time—November 1969 through June 1970. Of the 177 incidents reported, 83 had a cause factor of improper maintenance, 89 materiel factor and one was due to battle damage. Four were undetermined.

Perhaps it is significant that, in the cold months, December through March, 93 panels were lost from aircraft stationed in a cold climate. So does cold weather have anything to do with panels falling off aircraft in flight? Well, the rate does seem to decrease as the weather warms up. For instance, the computer lists 29 lost panels for February, 27 for March, 23 for April, 22 for May and 18 for June. Whether this is a coincidence or not we don't know, but any maintenance man who has had to button up an aircraft in sub zero weather can understand how it is possible to miss a fastener here and there when you're eager to get back to the warm shack.

As for the panels lost due to materiel failure, how many of these could have been prevented with proper inspection and, when necessary, replacement of worn and/or damaged fasteners.

So once again we remind everyone who has anything to do with panels, from the man performing the inspection to the pilot, who might detect a loose panel by tapping it with his hand, if it rattles there is something wrong.

relief valve

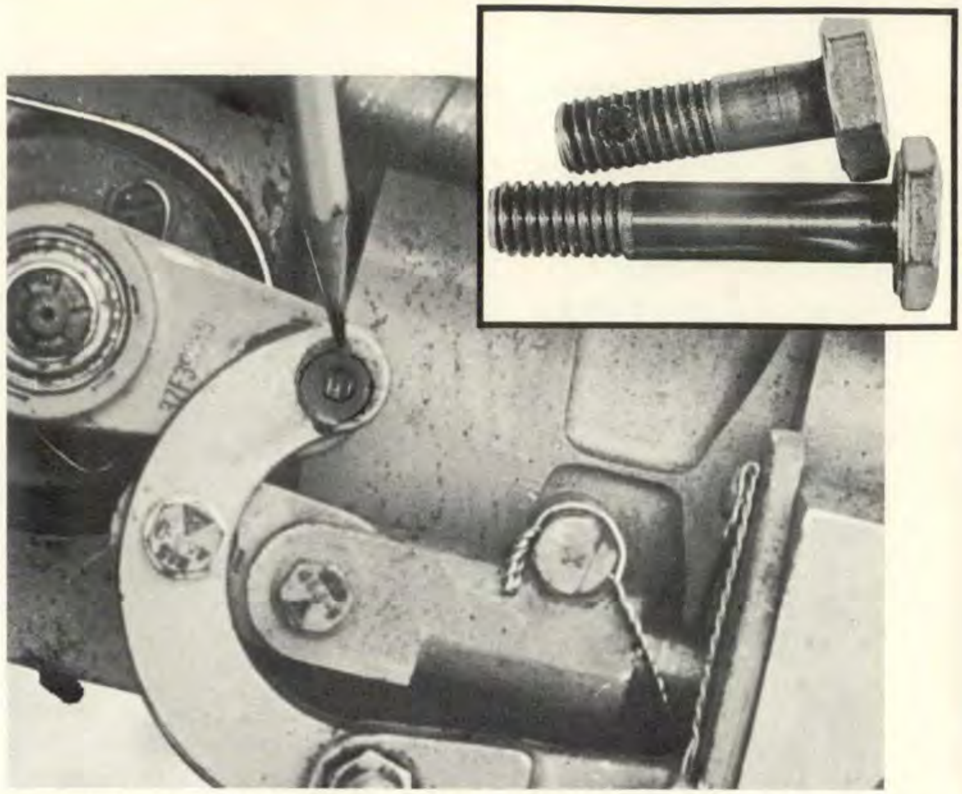
WHILE FLYING at 10,000 feet, the crew of a C-131 noticed a high pitch fluttering sound. Suspecting a pressurization problem from an undetermined source, the crew dumped cabin pressure. Back on the ground they found two things. One, the sealant around the base of the VHF antenna was missing; two, there was a three and one-half inch cut in the skin approximately 18 inches in front of the VHF antenna.

It was established that the missing sealant from the base of the antenna was the cause of the pressurization leak. The hole in the fuselage, although not contributing to the pressure problem, because it was surrounded by insulation, was caused by a B-2 stand that maintenance personnel had used to gain access to the antenna. The stand had been positioned too close to the fuselage and when the maintenance men mounted the stand, the additional weight caused the stand to punch a hole in the fuselage. The work was being done at night and the only light used was flashlights. Working around aircraft at night requires proper lighting and extra caution.

wrong hardware

THE F-84 was number four in a flight of four. Takeoff was normal until about 75 to 100 feet above the ground. Just as the pilot started gear retraction, the aircraft nosed down with the left wing low. It hit on the right side of the runway in this attitude and finally came to rest in a ball of fire some 2265 feet from point of impact. The pilot was rescued by fire department personnel.

This nearly fatal accident was caused by someone who installed an incorrect bolt in the lever assembly to the stabilator actuator control valve arm assembly. The bolt dropped out of the linkage immediately after the aircraft became airborne, resulting in the loss of stabilator control. No maintenance had been performed on the stabilator control mechanism since a combined IRAN and 200 hour inspection was performed by a contractor field team. The bolt installed was a common 10-32 machine bolt in lieu of the NAS 464-3A8 that should have been used. The bolt was also too short; only three threads protruded through the arm and lever assembly, not far enough for the locking mechanism on the nut to engage.



Right and wrong: Bottom bolt was correct one, but top bolt (incorrect) was installed. Photo below shows where bolt fell from.

In this accident the pilot survived but the aircraft was destroyed. Next time the pilot might not be so lucky. Make sure you are not the one to contribute to an out of control situation because you used unauthorized hardware.

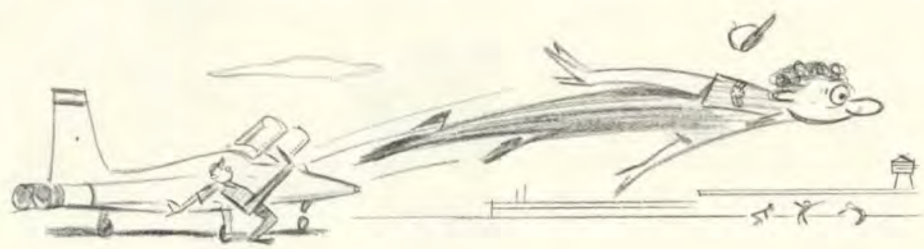
one jug short

IT IS POSSIBLE to spend your entire Air Force career and never witness a good example of why it is so all-fired important to document every discrepancy. However, once in a while something happens that really drives home the importance of writing it up, as is illustrated by the following incident.

The maintenance crew of a C-131, after towing the bird out of the hangar, were preparing to taxi it to the parking spot. The Nr 1 engine started okay, but in attempting to start Nr 2, it backfired, so the bird was taxied to the spot on Nr 1 engine only.

Investigation revealed the Nr 2 cylinder of the Nr 2 engine was missing. The 781 forms had not been properly documented.

a lousy way to fly



THE T-38 Nr 2 engine flamed out as the afterburners were selected to begin a supersonic run, and the engine would not relight with the normal or alternate methods. After an uneventful single engine landing, it was determined that failure to relight was caused by the main igniter plug. However, the cause of the flameout was something else.

Because the conditions at the time of the flameout were near the limit for afterburner initiation and within the area where rapid or abrupt throttle movements are not recommended, it was felt that rapid movement of the throttle caused the flameout. The instructor pilot, however, maintained that the throttles had not been moved rapidly or abruptly.

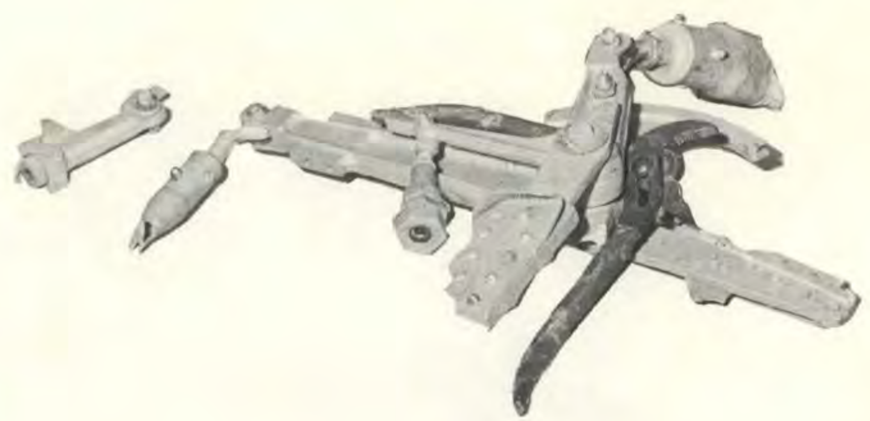
After the flameout checklist and test cell runs failed to reveal the cause of the flameout, the aircraft was released for an FCF, during which the engine flamed out. Further investigation revealed that all stator blades in stages 3 through 8 were too short. An analysis of the engine records revealed that the only work done in this area was performed at the overhaul facility.

It is interesting to review the history of the engine from overhaul to flameout. The engine was overhauled (zero time) on 20 July 70 and shipped to Base Nr 1. At Base Nr 1 the engine did not pass the test stand evaluations and did not accrue any flying time. To satisfy a critical engine shortage, the engine was shipped to Base Nr 2 where it did pass the test cell evaluation and was installed on three different aircraft; however, not one of the three aircraft ever made it off the ground with said engine installed, so the engine was removed and shipped to Base Nr 3 for major engine work. At Base Nr 3 the turbine wheel was found to have excessive clearance, and all 55 Nr 2 stage turbine rotor blades were replaced. The engine was then installed on a T-38 and flew satisfactorily for about 35 hours until the incident flameout occurred.

data deleted

SOME SHORTCUTS can be expensive as well as endanger human life. Such was the case of the F-102 pilot on takeoff roll. Approximately two seconds after afterburner light off an explosion occurred, coupled with immediate deceleration. The aircraft was brought to a halt approximately 9600 feet down the runway. The pilot egressed without injury and the fire was brought under control by the fire department. Investigation disclosed that inspection of AB return line elbow, PN 254498, had not been accomplished on the last periodic inspection as required by the TO. In addition the elbow jam nut, PN 231118 was found improperly installed. If you have ever had any doubts as to why you should follow the TO, this should make a believer out of you.

to look but no see



AN F-101 was on a test flight to check afterburner operation. The flight progressed with no discrepancies noted, including two negative G maneuvers to check for foreign objects in the cockpit. However, shortly thereafter, the control stick became restricted momentarily in aft movement. This restriction seemed to disappear, but then almost immediately the stick was forced forward. All attempts to regain control of the aircraft failed, so the pilot ejected at 8000 feet, 450 KIAS, with his zero-delay lanyard connected. The seat-man separator strap jammed in the takeup reel housing and the seat became entangled in the parachute shroud lines. Fortunately, the seat and parachute caught in the top of a tree and the pilot escaped with very minor injuries.

Investigation revealed that the primary cause of this accident was that a pair of water pump pliers had been left in the tail section of the aircraft! The pliers became entangled in the stabilator servo force link, jamming the pitch controls. The investigators were unable to determine ownership of the pliers; however, they concluded that the pliers had lain in the tail section throughout one or more FOD inspections. When checking for FOD, don't let your mind wander, otherwise you may look but not see a very dangerous situation.

short cut

ANOTHER CASE of the *short* cut being the *long* way.

The load crew, with the assistance of the loadmaster, was offloading an R-4360 engine from a C-141 aircraft using a 25K-loader. However, the loadmaster had informed the load crew that shoring would not be necessary inasmuch as he had onloaded the engine without shoring. As the wheels of the engine dolly rolled off the aircraft onto the K-loader, the K-loader rolled away from the aircraft approximately ten inches. The wheels of the engine dolly lodged between the aircraft ramp and the bed of the K-loader. The dolly frame came in contact with the cargo ramp at station 1278, punching two holes in the ramp approximately three inches long and one inch wide.

Investigation revealed the emergency brakes on the K-loader were defective. So, the defective brakes, along with the short cut decision not to use shoring, added up to two holes in the ramp. ★

UNDESI

drugs

C. L. Battistone

"Today I said goodbye to a Marine—more accurately a former Marine, because this young man had just been administratively discharged as an UNDESIRABLE. We took away his uniforms and, wearing civilian clothes, he was escorted through the main gate by the Military Police. His un-

RABLE

desirable discharge was the result of his use of marijuana and LSD and possibly other dangerous drugs.

"Two months ago this man sat in my office and spoke freely about drugs and how he was firmly in control of his habit, was bothering no one and was doing his job in the squadron in a creditable manner. One month later he was required to appear at the squadron administrative office to be advised that he was being processed for an administrative discharge and to sign the service record entries. He showed up —a complete vegetable! Apparently under the influence of drugs or experiencing a flashback from LSD, he was incapable of speaking, had little muscular control and wandered around in a daze, even falling as he was being taken to the hospital for treatment.

"It doesn't take much imagination to visualize what could have happened had this Marine been performing a high-power aircraft turn-up, loading ordnance material, driving a vehicle or otherwise been involved in any number of potentially hazardous duties at the time he suffered this attack. Whether it be operations in peace or war, we in aviation are constantly exposed to situations which require an alert mind, rapid reaction and quick, correct decisions. We *must* be able to trust and depend upon each other.

"Perhaps it sounds like hard drugs are the only real problem. How about marijuana, the innocent, harmless hallucinogen? It appears that even our Congress is currently exhibiting a permissive approach to legalizing marijuana in the United States, in spite of the fact that many other nations have tried it before and experienced grave social problems. Today there is no major nation in the world with legalized use of marijuana. A most concise and informative discussion of the subject can be found in SECNAVINST 6710.1A, along with detailed information on amphetamines, barbiturates, LSD and other drugs of a like nature. Enclosure (3) to this instruction should be mandatory reading for every military man, as it deals factually with marijuana and the user. It concludes with the following paragraph:

" 'Although marijuana may be a mild hallucinogen and the casual one or two-time user may not suffer from its use, as previously observed it is an unpredictable drug usually employed by unpredictable persons. (Chronic users tend to lose ambition, goal-directed behavior, achievement in life and personality maturity.) In the military, he is a danger to himself and his fellow servicemen especially in a combat zone or if he is involved in using moving equipment, military equipment or weapons. It is for this demonstrated *unreliability, incapacitation* of physical functions and *willful* infraction of civil and military regulations that the marijuana drug abuser becomes suspect for continuance in the service regardless of degree of use. As previously stated in notices and instructions to the field, the use of marijuana is dangerous, utterly inconsistent with the military responsibilities of every person in the naval service and is grounds for separation from the service through punitive and/or administrative means.'

"Obviously, aviation, ground safety and the physical and mental health of the individual serviceman suffer when even the 'mildest' of drugs are used by the unpredictable few.

"Today I said goodbye to a former Marine. He left my office with tears in his eyes and an Undesirable Discharge in his hand." ★

(Naval Aviation MECH)

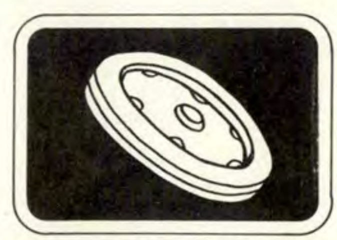
NUCLEAR SAFETY AID STATION

CRACKED CRANES

Subsequent to a reentry vehicle (RV) mating operation, an inspection of the Coles Crane boom was conducted and several cracks were found in welds of the inner boom section. Another Coles Crane was inspected and several cracks were found on the welds in the same location. Repair procedures and technical assistance were immediately furnished by the depot. A follow-on X-ray inspection of the boom sections was performed on the same two cranes and numerous other cracks were found. The cracks which were not visible without the use of X-ray were in various stages of propagation, and ranged in length from one-half to three inches. The importance of strict compliance with inspection procedures specified in TO 33-D4-2-43-1 for L3010 Coles Cranes cannot be overemphasized. The consequences of handling nuclear munitions with defective or unsafe handling equipment can be serious. The true professional will always take time to ensure that Aerospace Ground Equipment is in A-1 condition prior to use in nuclear weapon operations.

STOW YOUR CHOCKS

An RV G&C van was immobilized because the clutch couldn't be disengaged in the RV tractor. A National Defense Area was established. The Wing Commander, Wing Director of Safety, and Wing Nuclear Safety proceeded to the scene and discovered a wooden wheel chock had slipped between the clutch linkage rod and the spare tire rack. The wheel chock was removed and the clutch disengaged. All equipment was checked and the wheel chocks were stowed in the right floorboard area of the RV tractor. You can be sure that the Wing Commander provided choice guidance on the subject.



The left rear outer wheel came off an RV G&C van during its return trip to the support base. The van was stopped and maintenance assistance was requested by the maintenance team. No other damage was sustained by the van or its contents. A new hub and wheel assembly was dispatched to replace the wheel that came off and the van proceeded back to the support base with no further trouble. Investigation revealed that all six wheel studs had been sheared. A check of the

JUST A REMINDER

The season of inclement weather is upon us. Road hazards relative to weapon system convoy operations will increase. Last season the USAF was involved in at least two mishaps involving RV G&C vans where road and weather conditions were a contributing factor. Fortunately, the resulting damage to USAF equipment was minor, but the potential for serious consequences was present. In each incident, there were indications that the exercise of good judgment by the vehicle operators was questionable. The use of sound judgment and extra precautions during inclement weather conditions can preclude recurrence of mishaps such as those that occurred last season. BE ALERT for safety.

WHEEL FELL OFF

maintenance records indicated that the van was overdue for scheduled inspection. However, it was the only van available for dispatch. Compliance with torquing procedures in TO 36A9-8-40-1 and the inspection procedures in TO 21M-LGM30F-4-4 should insure a reliable wheel and help detect any serious material deficiency that may exist. The importance of properly retorquing the wheel retaining nuts, when required, cannot be over-emphasized.

BE ALERT

The munitions maintenance team had just positioned a reentry vehicle (RV) in the forward area of an RV van. As one team member moved the hoist toward the rear of the van, the loop formed by the power cable unexpectedly caught the RV nose cage assembly and bent it. This caused the upper collar of the cage to break off the nose tip of the RV. Had the team members been alert to their responsibility to detect potential accident/incident situations, this incident could have been prevented. The ability to anticipate and properly respond to unsafe conditions and situations such as this is an indication of the true professional. Be alert during the conduct of *all* operations involving nuclear weapons.

F-104G

A movie released not too many years ago, starring Steve McQueen, had the following line, "What we have here is a failure to communicate." Unfortunately, this line can be applied to many real life situations which result in mishaps. A recent example was the breaking of pulse plug break pins during a downloading operation. The failure to communicate which contributed to the situation was the failure to provide the user nation load crew personnel with a translated version of a technical order change. Changes to technical data must be in the hands of all affected personnel in a language they can understand. However, don't apply the failure to communicate idea only to the "language barrier." The failure to communicate can just as easily occur between two persons speaking the same language if they're not careful!

train 'n train

EXPLOSIVES SAFETY

John H. Kawka
Directorate of Aerospace Safety

Personnel error persists as the major cause of explosives accidents. A review of accident and incident reports reflects a lack of respect for explosives hazards, which may be the result of inadequate explosives safety training. Frequently, persons who lack the proper training are given a job to do and are then not properly supervised.

Training and retraining must be administered effectively to improve the proficiency and utilization of personnel. Significant improvements can be made by:

- Reviewing and updating on-the-job training programs, incorporating essential exposives safety principles.
- Including explosives safety in supervisory training.
- Using explosives accident/incident reports to identify training needs.
- On-the-spot retraining of personnel who violate safe job procedures.
- Establishing explosives safety information files as mandatory reading.
- Providing demonstrations when explaining new procedures or modifications, or the use of new equipment.
- Using commander's calls, section meetings and maintenance and operations briefings to maintain the personal contacts vital to safety efforts.

To be successful, an explosives safety program needs persons responsible for explosives safety training who are aggressive, ingenious and persistent, staff officers who appreciate the role of the explosives safety program in unit effectiveness, and commanders, supervisors and safety officers who provide their active and visible support.

Explosives accidents due to personnel error must be, and can be, eliminated. Anything less is unacceptable. ★

MAIL CALL

EJECTION

In *Ops Topics* for October you mentioned a "Don't Eject Light." Although the idea has much to commend it, I feel that it might be an unsafe act in itself. If a pilot has an F-4 in a situation which raises the question of ejection for the back seater, that pilot is probably pretty busy and doesn't have time to look at the very small green lights on the UHF radio panel. The pilot is better off devoting his attention to the aircraft's problems, or, if out of control at low altitude, initiating the ejection sequence for both crewmembers (granted the RF-4 accident cited is an exception for sequenced ejection). Too many PSOs have stayed with the aircraft too long waiting for the front seater to decide they should eject.

Capt Clifford R. Krieger
Wright-Patterson AFB, Ohio

You have a good point, Cliff; however, the author based the item on a procedure that was used successfully in a unit to which he was formerly assigned. Perhaps a better system could be designed into future two-seat aircraft.

BEEPER SNOOPER

With the return of the venerable old T-Bird to Nellis, came an unexpected headache. The seat pack beeper radio (URT-27) is prone to accidental actuation and cannot be turned off without popping the parachute. The big problem is finding the chute that contains the culprit.

Our squadron does not have a "beeper snooper" (field strength meter) to find runaway beepers, so we dreamed up a hunting system which is primitive but effective.

The RT-20B radio, which is the training version of the RT-10 Survival Radio, is tuned to 253.4 mc. However, when it is held about four feet from an operating beeper, the Guard signal bleeds into the I.F. strip of the RT-20B.

We placed the RT-20B on a counter about 20 feet away from the parachute rack after discovering that it sang loud and clear in the P.E. room. Then one by one, we carried each parachute out to the counter. Our problem was easily solved.

Since the RT-10 and the URT-27 beeper signals both bleed into the training radio, we assume that other survival and beeper radios now in the field will do likewise.

Capt Art Schneider
429th Tac Ftr Sq
Nellis AFB, Nevada

This "beeper snooper" is one of many local innovations devised by units to locate inadvertently actuated personnel locator beacons. SAAMA advises that the DRF-2 Locator, FSN 6625-403-7989CX, will be available for requisition in August 1971. The DRF-2 will be added to the TA 450.

CADMIUM CARE

One statement in the article "Cadmium Care" in the November 1970 issue was misleading—"Nickel-plated tools are embossed '21C' for identification."

21C is not an identification for nickel-plated tools as opposed to cadmium-plated tools. That number is the identifying prefix for part numbers of General Electric, Lynn, Massachusetts, aerospace ground equipment.

There were, several years ago, some cadmium-plated 21C tools available for use on GE-Lynn engines that had titanium parts, but these tools were recalled, stripped, and replated with nickel.

A General Electric JET SERVICE NEWS article in October 1968 covered this subject and suggested that TOs be used to determine which 21C tool should be used in which application to help to prevent misapplication.

While it is true that cadmium reacts detrimentally with titanium as described in the article, a survey of all General Electric tools showed that none are cadmium-plated in any area that will contact titanium engine parts.

Joseph J. Atkinson, Jr
Editor, GE Jet Service News

FAHRENHEIT TO CENTIGRADE

In the October 1970 issue on page 32 there is a simple method to convert from Centigrade to Fahrenheit. There is also a method to convert from Fahrenheit to Centigrade which may not be obvious to many people.

F, sub 32, add 1/9, divide by 2.

Exam. #1	*212*	*F*
	−32	*subtract 32*
	180	
	20	*add 1/9*
	2) 200	*divide by 2*
	100	*C*
Exam. #2	*50*	*F*
	−32	*subtract 32*
	18	
	2	*add 1/9*
	2) 20	*divide by 2*
	10	*C*
Exam. #3	*−40*	*F*
	−32	*subtract 32*
	−72	
	− 8	*add 1/9 (watch the sign)*
	2) −80	*divide by 2*
	−40	*C*

CONTINUED

MAIL CALL CONTINUED

I hope this might help; in addition I would like to add that example one, the boiling point of water is the best reference for the two temp scales when one is in doubt as to which way to calculate.

Sgt John W. Benson
Minn. ANG

UNDERSTANDING AND USING GROUND EFFECT

I would like to reply to a letter in your August Mail Call regarding "Understanding and Using Ground Effect." Although I do not have test data to refute or confirm the stated change in the Maximum Lift Coefficient, and since I am loath to stall my aircraft in ground effect, I think we should remember the established facts about ground effect as they pertain to various conditions of flight.

As discussed in your May issue, when an aircraft is very close to the ground, you achieve a reduction in the induced coefficient of drag and induced angle of attack for any specific lift coefficient. In this condition, the wing will require a lower angle of attack to produce the same lift coefficient (C_L) as shown in Figure 1. Also, since induced drag predominates at low speeds, the most significant reduction in thrust occurs only at low speeds such as at takeoff or touchdown (Figure 2).

Descending Into Ground Effect. When an aircraft descends into ground effect:

a. A smaller angle of attack will be required to produce the same lift coefficient. If a constant pitch attitude is maintained, an increase in total lift will occur which can result in "ballooning."

b. The thrust required at low speeds will be reduced.

c. There will be a nose down change in pitching moment.

d. In the majority of cases, there will be a change in the position error due to increased pressure at the static sources. This results in a lower indication of airspeed and altitude.

Ground Effect on Landing. If an aircraft comes into ground effect maintaining a constant angle of attack, the aircraft will experience an increase in the coefficient of lift and a reduction in thrust required. Hence, a "floating" sensation may be experienced. Because of the reduced drag, any excess airspeed prior to touchdown may incur a considerable "float" distance. In addition, aerodynamic braking will be of greatest significance only when partial stalling of the wing can be accomplished.

Ground Effect During Takeoff. An aircraft leaving ground effect will:

a. Require an increase in angle of attack to maintain the same coefficient of lift;

b. Experience an increase in induced drag and thrust required;

c. Experience a decrease in stability and a nose-up change in moment; and

d. Usually experience a reduction in static source pressure and an increase in indicated airspeed.

These general effects should point out the possible danger in attempting takeoff prior to recommended airspeeds. As an aircraft rises out of ground effect with a deficiency in airspeed, the increased induced drag during the climb may, in extreme conditions of high gross weight, density and temperature, permit the aircraft to become airborne but be incapable of flying out of ground effect and may settle back to the runway. Ground effect can be used to advantage by using the reduced drag to improve initial acceleration.

As was stated before, I also feel the phenomenon of ground effect is generally misunderstood. Although its effect will vary with aircraft type and operational procedures followed, I feel all pilots should be cognizant of the above-mentioned facts.

Maj L. J. Crabb
Canadian Forces Flying Training Standards Unit
Westwin, Manitoba

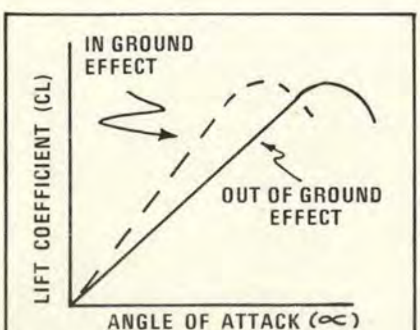


FIG. 1

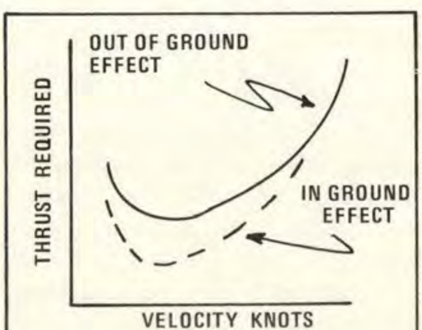


FIG. 2

☆ U.S. GOVERNMENT PRINTING OFFICE 1971 431-461/6

UNITED STATES AIR FORCE

WELL DONE AWARD

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.

ACROSS AND DOWN

Lt Col James T. Sidlo
PILOT

Maj Robert O. West
COPILOT

Maj Ernest G. Vorwerk
NAVIGATOR

SSgt Jose Salinas
FLIGHT ENGINEER

922nd Tactical Airlift Group, Kelly AFB, Texas

Lt Col Sidlo and crew were dropping Texas Army National Guard troops from a C-119 at "Rapido" Drop Zone near Waco, Texas. They landed at the municipal airport to pick up the DZ Safety Officer. The subsequent takeoff was normal until the pilot called for meto power. As the throttles were being retarded, Nr 1 propeller ran away to approximately 4000 RPM and airspeed dropped from 140 knots to 110-115 knots. Altitude was held at 100-200 feet AGL, and all emergency procedures were correctly executed; however, with no effect on the runaway propeller. Neither altitude nor airspeed could be increased in a straight ahead flight path. The decision was made to turn back and land downwind. Since rudder control was inadequate, the right wing was lowered 5 to 10 degrees to maintain direction, and Nr 2 engine was increased to maximum available power, much beyond maximum allowable power which had proven insufficient to maintain flight. Lowering of the gear to crash land straight ahead was considered; however, Lt Col Sidlo was able to fly the aircraft to a safe landing on the runway.

Professionalism and excellent aircrew coordination safely returned a combat ready aircrew and aircraft undamaged. WELL DONE! ★

let's get together on page 2. It'll be worth your time...

I promise

Our thanks to lovely Diane Hanson and the Weber Aircraft Co., which supplied the ejection seat.